Variation is a property of a population that occurs when individuals within a population differ in their characteristics. Variation can be caused by several factors such as genetic mutation, recombination (through sexual reproduction), or gene flow. Recombination and gene flow work by re-organizing and rearranging existing alleles in a population. Mutation is a source of completely new alleles. All of these factors result in variation within a population. Variation of individuals can be observed by examining external features, behaviors, or physiology of the organisms. External features are those traits that can easily be observed. Behaviors are activities or actions that generally help an organism survive in its environment. Physiology is the study of all the internal structures and functions of an organism.

Animals migrate by traveling long distances in search of new habitats. This may be due to climate changes or availability of food. True migration occurs as part of an animal’s life cycle and is an annual or seasonal occurrence. In some species, such as the monarch butterfly, migration is not carried out by just one generation. The butterflies mate and reproduce during the movement and successive generations (up to 3 or 4) travel to the next stage of the migration. This species migrates from colder North American regions to warmer southern regions, including the southern portions of the United States and Mexico, to escape from upcoming cold weather and food shortages. The butterflies respond to changes in the environment, enabling survival.

Hibernation is a way that animals adapt to the climate and their surrounding environment. Certain animals must be able to survive through extreme cold conditions. Hibernating animals store food as body fat during the end of the fall season. Physiological changes occur in the animal to help it survive long periods of time during these conditions. The animal’s body temperature, heartbeat, and breathing rate drops to save energy. The stored fat is able to last longer when the body’s metabolism slows down.

Some plants have specific structures that store energy (carbohydrates) or water. A storage bulb is an example of a plant structure that often times grows underground helping a plant survive adverse conditions. They are used by plants during times of the plant’s life cycle in which it needs a source of energy to help it survive during conditions such as extreme cold or heat, lack of available light, or during a drought.

Through natural selection, organisms in a population that are best adapted to their local environment increase in frequency relative to less well-adapted organisms over a number of generations. This difference in survival and reproduction is not due to chance. The genetic variation within a population leads to some individuals surviving and reproducing more successfully than others.

An example of natural selection can be seen with the Galapagos finches. A few million years ago, one species of finch migrated to the rocky Galapagos from the mainland of Central or South America. From this one migrant species would come many species of finch evolving from the single ancestor. The ancestral finch was a ground-dwelling, seed-eating finch. Selection pressures exerted by the ecological niches pushed the populations in various directions. On various islands, finch species have become adapted for various diets, including seeds, insects, flowers, leaves, etc. This process has resulted in many types of finches that differ mainly in their sizes and the shape of their beaks.

Selective breeding is the process of breeding plants and animals for particular genetic traits. Breeding is done intentionally in attempts to produce offspring with desirable characteristics or improved traits. Because selective breeding often times uses inbreeding techniques, it decreases the genetic variety in the gene pool. Through this process, however, animals can be bred for domestication. Human are able to breed animals for various domestic reasons such as food production or commodities (wool, cotton, etc.), help with types of work or transportation, scientific research, or for pets.

The internal structures of many organisms have adaptations that allow specific functions. The gills in fish are respiratory organs that extract dissolved oxygen from water, and excrete carbon dioxide. When a fish breathes, it takes in water and forces the water through the gill openings so that it passes over the gills to the outside. Gases are exchanged through the thin walls in gills allowing blood to carry oxygen to other parts of the body. Carbon dioxide passes from the blood through the thin gill tissue into the water.

Hollow bones in birds make their bodies lighter and allow them to fly long distances without carrying a lot of weight. The hollow bones have the same hard exterior found in bones of most other organisms, but instead of being filled with marrow, they have an air cavity inside. In some bones, the hollow cavities contain extensions of the air sacs from the lungs. These air sacs help the bird get oxygen it needs to fly quickly and easily. To give the bones added strength, they are supported by internal struts – structures inside that help brace the bone so that it can withstand pressure along its sides. The struts give the bones added strength so that it can withstand the movements of birds such as taking off, flying, and landing.

Plants also have adaptations to help them survive in different areas. In vascular plants, the xylem is an important structure because it transports water and other nutrients from the root system to the rest of the plant. The hollow structure and lignin in the lining of the xylem make it ideal for water and solute transportation through the use of adhesive forces and capillary action.

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